RESEARCH IMPLEMENTATION REPORT – 2009

ARIZONA TRANSPORTATION RESEARCH CENTER

APRIL 2010

From: Project SPR 576 –
US-93 Bighorn Sheep Study: Distribution and Trans-Highway Movements of Desert Bighorn Sheep in Northwestern Arizona

Arizona Department of Transportation

About the Arizona Transportation Research Center

The Arizona Transportation Research Center (ATRC) directs the Arizona Department of Transportation (ADOT) research program.

ATRC MISSION – To pursue and share knowledge in transportation.

ATRC VISION – ATRC sets the national standard of excellence for transportation research, product evaluation, and library services.

The research program encompasses seven research emphasis areas:

- Environment
- Intelligent Transportation Systems
- Maintenance
- Materials & Construction
- Planning & Administration
- Structures
- Traffic & Safety

The research program also includes the ADOT Product Resource Investment Deployment and Evaluation (PRIDE) program. The review and acceptance of new products for possible use by ADOT is coordinated through the PRIDE program. The approved products list (APL) is also maintained under the PRIDE program.

ATRC houses and operates the ADOT Library. The library is maintained by a full-time librarian. The ATRC Library is open to ADOT employees, transportation faculty in Arizona universities, and Arizona local and county transportation staff.

The library catalog is available on the Internet. The library collection currently counts over 30,000 entries, including over 60 journal and magazine subscriptions.

SPR-535 (2) Evaluation of the Integration of a Commercial Vehicle Information System Network (CVISN) at the Nogales Port of Entry. Published in 2008.

In 1995, the U.S. Congress directed the Federal Highway Administration to describe how and when it would design, deploy, and maintain a commercial vehicle information system network (CVISN). The CVISN conceptualization focused on inspections and safety ratings, out-of-service orders and registration denials, objectives and constraints, and data collection and use.

The three CVISN operation capabilities are safety information exchange, credentials administration, and electronic screening. A Level 1 implementation results in basic operation functionality in these three functional areas. A Level 2 implementation results in advanced operation functionality in these three areas. Using data collected by commercial vehicle inspection officers in Arizona, this study evaluated the integration of CVISN at the Nogales port of entry and identified opportunities for improving operation effectiveness in the future.

The study analyzed commercial vehicle entries and clearance rates from 2005 to 2007 with CVISN. The results indicate that the cost efficiencies of the port's inspection booths could potentially be improved by roughly 30 percent.

Implementation

The Arizona CVISN implementation includes port of entry "super booths" that are equipped with all of the requisite communication capabilities to interact with the designated intelligent transportation system (ITS) networks. Safety information is exchanged through creating and querying of inspection data. Credentials such as vehicle registrations and fuel tax reports are administered electronically. Vehicles are electronically screened to identify the carrier, the vehicle, and the driver and to determine if a physical inspection is necessary.

Recent developments in a proposed "Phase 3" project have indicated that plans for redevelopment of the Nogales port of entry facility are almost complete with an estimated 42-month construction time frame. Within that time frame, a proposed pilot study would be conducted on the effectiveness of transponder/reader performance and technology and inspection process issue resolution. ¤¤

SPR-402: Evaluation of Moisture Sensitivity Properties of ADOT Mixtures on US 93. Published in 2005.

This University of Nevada-Reno (UNR) report documents the performance of three asphaltic concrete sections in an effort to assess moisture sensitivity design requirements. The three evaluated sections included: a Superpave-designed section with 1-inch nominal maximum aggregate size, a Superpave-designed section with 3/4-inch nominal maximum aggregate size, and an ADOT Marshall-designed section with 3/4-inch nominal maximum aggregate size. The two Superpave sections did not include an anti-stripping additive based on the results of the Superpave specified moisture sensitivity test (AASHTO T-283). The ADOT section included 2% portland cement based on the results of the ADOT immersion compression test. This research project evaluated the moisture sensitivity of the hot mix asphalt (HMA) mixtures used on all three sections using the AASHTO T-283 procedure and the ADOT immersion compression test procedure (ARIZ 802). Laboratory mixtures and field cores were tested by the modified AASHTO T-283 method using both the freeze-thaw and no freeze-thaw conditioning measures.

The Superpave field sections demonstrated both adhesive and cohesive moisture damage, resulting in premature fatigue cracking. The ADOT field section, with portland cement added to reduce moisture sensitivity, performed well. All sections were constructed using the same aggregate and asphalt cement source.

Implementation

This research has demonstrated that the results of AASHTO T-283, which indicated that anti-strip additives were not required, are not necessarily correct. As a result of this research, ADOT Standard Specification Section 417, which applies to all non-rubberized, dense-graded Strategic Highway Research Program (SHRP) mixtures, has been modified. Test method AASHTO T-283 for moisture sensitivity has been eliminated and replaced with immersion compression (ARIZ 802). Interstate 10 from Quartzsite to Dome Rock is one of many highways constructed with the revised gyratory design using immersion compression to evaluate moisture sensitivity. ¤¤

SPR-402-2: Development of Performance-Related Specifications for Asphalt Pavements in the State of Arizona. Published in 2008.

This Arizona State University study was commissioned to determine what additional asphalt properties could be used to predict pavement performance. Characteristics such as the asphalt cement binder properties, subgrade soil properties, aggregate base properties, mixture properties (stiffness, thermal fracture, deformation, fatigue performance, strain), environmental conditions, and traffic loading were determined for typical materials and roadways.

Implementation

As a result of this research, ADOT has an extensive material property database for use in pavement design. Since then the Mechanistic Empirical Pavement Design Guide (M-E PDG) has been made available for adoption. This new database will enable ADOT to calibrate this new M-E PDG to local conditions, enabling far greater accuracy in predicting pavement performance and resulting in more economical pavement designs. Calibration of the M-E PDG is being conducted as a part of project SPR-606. ¤¤

SPR-524: Development of Mix Design Procedures for Gap Graded Asphalt Rubber Asphaltic Concrete (ARAC). Published in 2008.

The objective of this project was to formally document the mix design procedure used by the Arizona Department of Transportation (ADOT) for asphalt rubber asphaltic concrete (ARAC) mixtures. Prior to this project, ADOT performed all the designs for these mixtures in-house and had no formal documentation of the procedure. The procedure documented as part of this project is now included in the ADOT Materials Testing Manual as ARIZ 832.

Implementation

During the same period that this project was being conducted, ADOT was also revising its specifications to include a section for end-product ARAC mixtures. This new specification (along with a reference to ARIZ 832) was ultimately adopted as ADOT Standard Specification Section 415. Section 415 includes the requirement that mix designs be performed by the contractor rather than ADOT. End-product specifications have historically produced superior paving projects and are standard for the industry today. ¤¤

SPR-576: US 93 Bighorn Sheep Study: Distribution and Trans-Highway Movements of Desert Bighorn Sheep in Northwestern Arizona. Published in 2007.

(This summary was first published in the 2007 Implementation Report. An update is provided here in view of recent implementation developments).

Backed by funding from the Federal Highway Administration (FHWA) and ADOT, the Arizona Game and Fish Department monitored desert bighorn sheep via satellite telemetry, ground observations, and track beds between 2004 and 2006, primarily to determine distribution and movements relative to mileposts (MP) 3 to 17 of U.S. Highway 93 in the Black Mountains of northwestern Arizona. Bighorns concentrated trans-highway movements in the area of proposed highway realignments between MP 3 and MP 17 at five continuous, linear, elevated ridgelines. Of those five, 82 percent of highway crossings between MP 3 and MP 17 occurred near ridgelines at MP 3.3, 5.1, and 12.2. The research team concluded that highway crossing structures at these locations would promote highway permeability at a level ensuring genetic heterogeneity and vigor of the resident desert bighorn sheep population.

Implementation

It was determined that roadway expansion would potentially be a barrier to the bighorn, disrupting migration patterns and affecting herd sustainability. The innovative solution? Build three wildlife overpasses – the first in the lower 48 states – at MP 3.3, 5.1, and 12.2. Design of the overpasses has been completed and construction is in the initial stages.

ADOT approved a new research project for fiscal year 2009 titled “Evaluation of Measures to Promote Desert Bighorn Sheep Highway Permeability: US Highway 93”. This new effort will continue a thorough collection and analysis of data before and during overpass construction, and potentially (if subsequently funded) after the construction is completed.

The figure shows what an overpass at MP 12.2 might look like upon completion.

¤¤

Fiscal Year 2008 Completed Research Projects

ID #	Title	Project Manager
SPR-402	*Development of Performance-Related Specifications for Asphalt Pavements*	Dimitroplos
SPR-473	*Arizona Intelligent Vehicle Systems Evaluation*	Owen
SPR-524	*Development of Mix Design Proceedures and End Product Specifications for Gap-Graded Asphalt-Rubber Asphalt Concrete*	Dimitroplos
SPR-534	*Digital Signature Feasibility Study*	Semmens
SPR-540	*Evaluation of Measures to Minimize Wildlife Vehicle Collisions and Maintain Wildlife Permeability Across Highways*	Kombe
SPR-544	*What Is the Best Mix of Service Delivery Strategies that Can Be Employed to Reduce Customer Time in Motor Vehicle Division Field Offices?*	Semmens
SPR-574	*Use of NDT Equipment for Construction Quality Control of Hot Mix Asphalt Pavements*	Dimitroplos
SPR-591	*High Crash Risk Unsignalized Intersections*	Harris
SPR-592	*Building Tribal Traffic Safety Capacity*	Harris
SPR-593	*Development and Implementation of a Regional Safety Management Database*	Harris
SPR-597	*Highway Safety Incentive Report*	Harris
SPR-598	*Should State DOTs Prefer Bicycle Lanes or Wide Curb Lanes?*	Semmens
SPR-608	*Development of Rational Pay Factors Based on Concrete Compressive Strength Data*	Dimitroplos
SPR-609	*Driver Education for Safety in Adverse Driving Conditions*	Semmens
SPR-610	*Implementing a Statewide Rideshare and Vanpool Program in Arizona*	Semmens
SPR-612	*Evaluate Effectiveness of Cattle Guards and Fencing*	Harris
SPR-614	*Origins and Destinations Study of Older Persons*	Semmens
SPR-615	*ITS Concepts for Rural Corridor Operations*	Owen
SPR-629	*Analysis of Capacity and Operations after Retrofit Improvements of Happy Valley and I-17 Roundabout Traffic Interchange*	Harris
SPR-635	*Improved Efficiency Through Driving Simulator Training*	Owen
SPR-637	*Cost/Benefit Analysis of Electronic License Plates*	Semmens
SPR-639	*Effectiveness of Various Pre-Emergent Herbicides*	Semmens

Fiscal Year 2009 Completed Research Projects

ID #	Title	Project Manager
SPR-396-1	*LTPP and Other Test Section Management and Evaluation: SPS-1*	Dimitroplos
SPR-535-2	*Evaluation of the Integration of CVISN at the Nogales Port of Entry*	Semmens
SPR-571	*Comparative Cost of Risk Study*	Semmens
SPR-575	*Concrete Aggregate Durability Study*	Dimitroplos
SPR-584	*Survey of Traffic Noise Reduction Products, Materials, and Technologies*	Kombe
SPR-588	*A Study of the Effectiveness of Bighorn Underpasses on State Route 68*	Kombe
SPR-590	*Development of a Rational Methodology to Assess Performance-Related Pay Factors for Asphalt Pavements*	Dimitroplos
SPR-601	*Cost Evaluation of Cross-Border Truck Emissions Testing Using Heavy Duty Remote Sensing (HDRS) Equipment*	Kombe
SPR-636	*"Heat Island" Effects on Pavement*	Dimitroplos
SPR-670	*Restraint Use (Seat Belt and Child Passenger Seats) Survey*	Harris

ATRC CONTACT INFORMATION

ATRC STAFF	PHONE NUMBERS	E-MAIL ADDRESSES
Director		
Anne Ellis, Ph.D.	(602) 712-6910	aellis@azdot.gov
Research Project Managers		
Christ Dimitroplos, PE	(602) 712-7850	cdimitroplos@azdot.gov
Estomih (Tom) Kombe, Ph.D., PE	(602) 712-3135	ekombe@azdot.gov
Dianne Kresich	(602) 712-3134	dkresich@azdot.gov
Jason Harris, MBA, PE, PMP	(602) 712-6927	jharris@azdot.gov
Steve Rost, Ph.D.	(602) 712-6348	srost@azdot.gov
Librarian		
Dale Steele	(602) 712-3138	dsteele@azdot.gov
Technical & Administrative Support		
Evelyn Howell – Technical Editor	(602) 712-6346	ehowell@azdot.gov
Anthony Kerin – PRIDE Program Engineering Assistant	(602) 712-6430	akerin@azdot.gov
FAX	(602) 712-3400	